

27. The integrated circuit package of claim 3, wherein said heat sink comprises an extension member having said side portion.
28. The integrated circuit package of claim 27, wherein said extension member comprises a finger.
29. The integrated circuit package of claim 10, wherein said heat sink comprises an extension member having said side portion.
30. The integrated circuit package of claim 29, wherein said extension member comprises a finger.
31. The integrated circuit package of claim 11, wherein said heat sink comprises an extension member having at least one of said plurality of side portions.
32. The integrated circuit package of claim 31, wherein said extension member comprises a finger.

REMARKS

I. Form PTO 1449

Applicants respectfully request confirmation that the Examiner has reviewed and considered the English Translation of French Publication No. 2 609 841, and further request the Examiner's initials where appropriate on the enclosed Form PTO-1449.

II. The Drawings

The drawings have been objected to "as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference sign(s) not mentioned in the description: 116-1, 116-2, 116-3, 116-4, 202-1, 202-2, 202-3, 202-4." Applicants have amended the specification for greater clarity, and submit that no new matter has been added.

In response to the Notice of Draftsperson's Patent Drawing Review, Applicants have submitted herewith a Submission of Corrected Formal Drawings, containing eleven (11) sheets of drawings.

Accordingly, Applicants respectfully request that all objections to the drawings be withdrawn.

III. The Specification

The abstract of the disclosure has been objected to "because the encapsulant material for encapsulating the thermally conductive element and the heat sink is not mentioned."

Applicants have amended the abstract, and respectfully request that the objection be withdrawn.

The Examiner has also noted that "[t]he title of the invention is not descriptive [and that] [t]he following title is suggested: 'ENHANCED THERMAL DISSIPATION INTEGRATED CIRCUIT PACKAGE.'"

Applicants have amended the title of the invention.

IV. Status of the Claims

Claims 2-32 are pending in this application. The Examiner has rejected claims 1-21, and has withdrawn from consideration claims 22-26. Applicants have cancelled claim 1, have amended claims 2-6, 8-10, 13, 20 and 21, and have added claims 27-32.

V. Rejection Under 35 U.S.C. § 112

The Examiner has rejected claim 13 under 35 U.S.C. § 112, second paragraph, "as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention." Applicants respectfully traverse this rejection.

In the interest of providing greater clarity to the invention as recited in claim 13, Applicants have amended claim 13 and respectfully submit that the claim as amended is in condition for allowance.

Accordingly, Applicants respectfully request that the rejection under 35 U.S.C. § 112 be withdrawn.

VI. Rejections Under 35 U.S.C. § 102

The Examiner has rejected claims 1, 2, 4, 6 and 10 under 35 U.S.C. § 102(b) “as being clearly anticipated by Zimmerman (U.S. 5,172,213).” Applicants respectfully traverse these rejections.

Applicants have cancelled claim 1.

Claims 2, 4 and 6 have been amended to depend from claim 3, which has been amended to incorporate claim 1 (from which claim 3 originally depended). Applicants note that claim 3 is directed to an integrated circuit package including a heat sink wherein a top portion and a side portion of the heat sink are exposed to the surroundings of the package.

Applicants also note that claim 10 as amended is directed to an integrated circuit package including a heat sink having a top portion and a side portion thereof exposed to the surroundings of the package.

Applicants respectfully submit that Zimmerman fails to disclose or suggest an integrated circuit package including a heat sink wherein a top portion and a side portion of the heat sink are exposed to the surroundings of the package. Because Zimmerman therefore fails to disclose or suggest any of the integrated circuit packages recited in claims 2, 4, 6 and 10, Applicants respectfully submit that claims 2, 4, 6 and 10 are not anticipated by Zimmerman. Claim 1 has been cancelled.

Accordingly, Applicants submit that claims 2, 4, 6 and 10 are in condition for allowance, and thus respectfully request that the rejections under 35 U.S.C. § 102 be withdrawn.

VII. Rejections Under 35 U.S.C. § 103

A. Claim 3

The Examiner has rejected claim 3 under 35 U.S.C. § 103(a) “as being unpatentable over Zimmerman (U.S. 5,172,213) as applied to claim 1 above, and further in view of Long et al. (U.S. 5,175,612).” Applicants respectfully traverse this rejection.

Claim 3 is directed to an integrated circuit package including a substrate.

Applicants respectfully submit that neither Zimmerman nor Long et al., either individually or in combination with one another, discloses or suggests an integrated circuit package including a substrate. Applicants note that Zimmerman discloses only leads 18. In particular, the leads 18 of Zimmerman “are formed from punched sheet stock.” See Zimmerman at column 3, lines 43-44. Similarly, Long et al. discloses only metallic leads 48. See Long et al. at column 5, lines 18-19.

Because neither Zimmerman nor Long et al. discloses or suggests an integrated circuit package comprising a substrate, Applicants respectfully submit that claim 3 is not rendered obvious by the Examiner’s combination of Zimmerman with Long et al.

In addition, Applicants do not concede that it is proper to combine Zimmerman with Long et al. as the Examiner has suggested. Applicants respectfully mention that the Examiner bears the burden of “showing some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings of the references.” In re Fine, 837 F.2d 1071, 1074 (Fed. Cir. 1988). The Federal Circuit has also cautioned that “[o]ne cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention.”

Id. at 1075; see also In re Newell, 891 F.2d 899, 901 (Fed. Cir. 1989) (reversing obviousness rejection because “[t]here [was] no suggestion or motivation in the prior art to combine these elements as combined by [the applicant]....”); Fromson v. Advance Offset Plate, 755 F.2d 1549, 1556 (Fed. Cir. 1985) (“The critical inquiry is whether ‘there is something in the prior art as a whole to suggest the desirability, and thus the obviousness, of making the combination.’”) (emphasis in original). Applicants respectfully submit that the Examiner has not provided sufficient objective teaching in the prior art or knowledge generally available to one of ordinary skill in the art which would lead such an individual to combine the relevant teachings of the references.

Accordingly, Applicants submit that claim 3 is in condition for allowance, and respectfully request that the rejection of claim 3 be withdrawn.

B. Claims 5 and 7

Claims 5 and 7 have been rejected under 35 U.S.C. § 103(a) “as being unpatentable over Zimmerman (U.S. 5,172,213) as applied to claim 1 and 6 above, and further in view of Ference et al. (U.S. 6,265,771).” Applicants respectfully traverse these rejections.

Claim 5 as amended depends from claim 3. Due to the amendment of claim 6, claim 7 also depends from claim 3. Claim 3 is directed to an integrated circuit package including an encapsulant material encapsulating a heat sink wherein a top portion and a side portion of the heat sink are exposed to the surroundings of the package.

Applicants respectfully submit that neither Zimmerman nor Ference et al. discloses or suggests an integrated circuit package including an encapsulant material encapsulating a heat sink wherein a top portion and a side portion of the heat sink are exposed to the surroundings of the package. Thus, Applicants respectfully submit that neither claim 5 nor claim 7 is rendered obvious by the Examiner’s combination of Zimmerman with Ference et al.

In addition, Applicants do not concede that it is proper to combine Zimmerman with Ference et al. as the Examiner has suggested. Applicants respectfully submit that the Examiner has not provided sufficient objective teaching in the prior art or knowledge generally available to one of ordinary skill in the art which would lead such an individual to combine the relevant teachings of the references.

Accordingly, Applicants submit that claims 5 and 7 are in condition for allowance, and respectfully request that the rejections of claims 5 and 7 be withdrawn.

C. Claims 8 and 9

Claims 8 and 9 have been rejected under 35 U.S.C. § 103(a) “as being unpatentable over Zimmerman (U.S. 5,172,213) as applied to claim 1 above, and further in view of Daves et al. (U.S. 6,091,603).” Applicants respectfully traverse these rejections.

Claims 8 and 9, as amended, each depend from claim 3. Claim 3 is directed to an integrated circuit package including an encapsulant material encapsulating a heat sink wherein a top portion and a side portion of the heat sink are exposed to the surroundings of the package.

Applicants respectfully submit that neither Zimmerman nor Daves et al. discloses or suggests an integrated circuit package including an encapsulant material encapsulating a heat sink wherein a top portion and a side portion of the heat sink are exposed to the surroundings of the package. Thus, Applicants respectfully submit that neither claim 8 nor claim 9 is rendered obvious by the Examiner’s combination of Zimmerman with Daves et al.

In addition, Applicants do not concede that it is proper to combine Zimmerman with Daves et al. as the Examiner has suggested. Applicants respectfully submit that the Examiner has not provided sufficient objective teaching in the prior art or knowledge generally available to one of ordinary skill in the art which would lead such an individual to combine the relevant teachings of the references.

Accordingly, Applicants submit that claims 8 and 9 are in condition for allowance, and respectfully request that the rejections of claims 8 and 9 be withdrawn.

D. Claims 11-13, 15, 20 and 21

Claims 11-13, 15, 20 and 21 have been rejected under 35 U.S.C. § 103(a) “as being unpatentable over Lai et al. (U.S. 6,236,568) in view of Long et al. (U.S. 5,175,612).” Applicants respectfully traverse these rejections.

Claim 11 is directed to an integrated circuit package including an encapsulant material formed to encapsulate substantially all of a heat sink except a top portion and side portions of the heat sink. Claims 12, 13, 15 and 20 depend from claim 11.

Claim 21 as amended is directed to an integrated circuit package including means for encapsulating a semiconductor die, a thermally conductive element and a heat sink such that a top portion a said side portion of the heat sink are exposed to the surroundings of the package.

As an initial matter, Applicants note that the Examiner admits that “Lai fails to disclose an encapsulant material encapsulating a heat sink except the top portion and the side portions.” See Office Action at page 8. However, the Examiner nevertheless concludes that “it would have been obvious to incorporate the heat sink [of Long et al.] with the device of Zimmerman, since the heat sink would provide increased surface area and irregular topography for adhering to the epoxy as taught by Long.” Id.

Applicants respectfully submit that Long et al. provides no teaching or suggestion toward modifying the package of Lai et al. to include an encapsulant material encapsulating substantially all of a heat sink except a top portion and side portions of the heat sink. Applicants also submit that Long et al. provides no suggestion or teaching toward modifying the package of Lai et al. to include means for encapsulating a semiconductor die, a thermally conductive

element and a heat sink such that a top portion a said side portion of the heat sink are exposed to the surroundings of the package.

As mentioned above, an invention is not obvious unless the prior art suggests or provides motivation for combination of its elements, and the Federal Circuit has also cautioned that one cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention.

It is respectfully submitted that neither Lai et al. nor Long et al. provides such motivation to combine, and that the Examiner has not identified the source of any knowledge generally available that would lead one of ordinary skill to combine Lai et al. with Long et al. in the manner provided in the Office Action.

Accordingly, Applicants submit that claims 11-13, 15, 20 and 21 are in condition for allowance, and respectfully request that the rejection of claims 11-13, 15, 20 and 21 under 35 U.S.C. § 103 be withdrawn.

E. Claim 14

Claim 14 has been rejected under 35 U.S.C. § 103(a) “as being unpatentable over Lai et al. (U.S. 6,236,568) and Long et al. (U.S. 5,175,612) as applied to claim 11 above, and further in view of Ference et al. (U.S. 6,265,771).” Applicants respectfully traverse this rejection.

Claim 14 depends indirectly from claim 11.

As discussed above, Applicants respectfully submit that the Examiner has not explained why one of ordinary skill in the art would be motivated to combine the teachings of Lai et al. with Long et al. to achieve the integrated circuit package as recited in claim 11. The Examiner’s citation of Ference et al. in further combination with Lai et al. and Long et al. does not remedy the lack of motivation to combine. Indeed, Applicants respectfully submit that such

a combination is exactly the type of hindsight reconstruction that the Federal Circuit has cautioned against.

Accordingly, Applicants submit that claim 14 is in condition for allowance, and respectfully request that the rejection of claim 14 under 35 U.S.C. § 103 be withdrawn.

F. Claim 16

Claim 16 has been rejected under 35 U.S.C. § 103(a) “as being unpatentable over Lai et al. (U.S. 6,236,568) and Long et al. (U.S. 5,175,612) as applied to claim 11 above, and further in view of Daves et al. (U.S. 6,091,603).” Applicants respectfully traverse this rejection.

Claim 16 depends from claim 11.

As discussed above, Applicants respectfully submit that the Examiner has not explained why one of ordinary skill in the art would be motivated to combine the teachings of Lai et al. with Long et al. to achieve the integrated circuit package as recited in claim 11. The Examiner’s citation of Daves et al. in further combination with Lai et al. and Long et al. does not remedy the lack of motivation to combine. Indeed, Applicants respectfully submit that such a combination is exactly the type of hindsight reconstruction that the Federal Circuit has cautioned against.

Accordingly, Applicants submit that claim 16 is in condition for allowance, and respectfully request that the rejection of claim 16 under 35 U.S.C. § 103 be withdrawn.

G. Claim 17

Claim 17 has been rejected under 35 U.S.C. § 103(a) “as being unpatentable over Lai et al. (U.S. 6,236,568) and Long et al. (U.S. 5,175,612) as applied to claim 11 above, and further in view of Zimmerman et al. (U.S. 5,172,213).” Applicants respectfully traverse this rejection.

Claim 17 depends from claim 11.

As discussed above, Applicants respectfully submit that the Examiner has not explained why one of ordinary skill in the art would be motivated to combine the teachings of Lai et al. with Long et al. to achieve the integrated circuit package as recited in claim 11. The Examiner's citation of Zimmerman in further combination with Lai et al. and Long et al. does not remedy the lack of motivation to combine. Indeed, Applicants respectfully submit that such a combination is exactly the type of hindsight reconstruction that the Federal Circuit has cautioned against.

Accordingly, Applicants submit that claim 17 is in condition for allowance, and respectfully request that the rejection of claim 17 under 35 U.S.C. § 103 be withdrawn.

H. Claim 18 and 19

Claims 18 and 19 have been rejected under 35 U.S.C. § 103(a) "as being unpatentable over Lai et al. (U.S. 6,236,568) and Long et al. (U.S. 5,175,612) as applied to claim 11 above, and further in view of Shin et al. (U.S. 5,854,511)." Applicants respectfully traverse these rejections.

Claims 18 and 19 depend, directly or indirectly, from claim 11.

As discussed above, Applicants respectfully submit that the Examiner has not explained why one of ordinary skill in the art would be motivated to combine the teachings of Lai et al. with Long et al. to achieve the integrated circuit package as recited in claim 11. The Examiner's citation of Shin et al. in further combination with Lai et al. and Long et al. does not remedy the lack of motivation to combine. Indeed, Applicants respectfully submit that such a combination is exactly the type of hindsight reconstruction that the Federal Circuit has cautioned against.

Accordingly, Applicants submit that claims 18 and 19 are in condition for allowance, and respectfully request that the rejection of claims 18 and 19 under 35 U.S.C. § 103 be withdrawn.

VIII. Conclusion and Request for Reconsideration

Applicants request reconsideration of the instant application in view of the aforementioned amendments and remarks. Although other features of the claims in the present application are also significant, Applicants respectfully submit that the claims are allowable for at least the aforementioned reasons. Accordingly, Applicants respectfully request that the rejections under §§ 112, 102 and 103 be withdrawn and that the pending claims be allowed.

In the event that a telephone conference would advance examination of this application, the Examiner is invited to contact the undersigned at the number provided.

IX. Authorization

Applicants have submitted herewith a Petition For Extension of Time, which requests a three month extension of time for filing this Amendment and Request For Reconsideration, and the Submission of Corrected Formal Drawings submitted herewith. In the event that the Commissioner determines that additional fees are due for these papers, the undersigned hereby authorizes the Commissioner to charge any fees required therefor to

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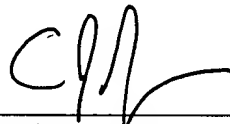
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Milbank's deposit account no. 13-3250, order no. 36080-00800. A DUPLICATE COPY OF
THIS PAGE IS ENCLOSED HEREWITH.

Respectfully submitted,
Milbank, Tweed, Hadley & McCloy LLP

May 6, 2003

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IN THE TITLE

Please amend the title as follows:

(One Time Amended) Enhanced Thermal Dissipation Integrated Circuit Package
[and Method of Manufacturing Enhanced Thermal Dissipation Integrated Circuit Package].

IN THE SPECIFICATION

On page 8 at lines 18-23, please amend the specification as follows:

(One Time Amended) Further details of the heat sink 110 of a subassembly shown in FIG. 4B include extending fingers 116-1, 116-2, 116-3 and 116-4 [116] of the support structure 114. As shown in plan view by FIG. 4B, the fingers 116-1, 116-2, 116-3 and 116-4 [116] may be sized and shaped to engage matching wells or recesses 202-1, 202-2, 202-3 and 202-4 [202] in the supporting walls of the carrier 200 (step 1125). Such fingers 116-1, 116-2, 116-3 and 116-4 [116] in whole or in part support the heat sink 110 prior to encapsulation (step 1130) and align the heat sink 110 above the semiconductor die 130.

IN THE ABSTRACT

Please amend the Abstract as follows:

(One Time Amended) The present invention relates to an integrated circuit package having a semiconductor die electrically connected to a substrate, a heat sink having a portion thereof exposed to the surroundings of the package, a thermally conductive element thermally coupled to the [a] semiconductor die and the [a] heat sink, and an encapsulant material encapsulating the thermally conductive element and the heat sink such that a top and a side portion of the heat sink are exposed to the surroundings of the package [and a method of manufacturing said integrated circuit package. The thermally conductive element is integrated into the package to enhance thermal dissipation characteristics of the package].

IN THE CLAIMS

Please amend claims 2-6, 8-10, 13, 20 and 21 as follows:

2. (One Time Amended) The integrated circuit package of claim 3 [1], wherein said thermally conductive element is substantially shaped as a right rectangular solid.

3. (One Time Amended) An [The] integrated circuit package [of claim 1], comprising:

a semiconductor die electrically connected to a substrate;

a heat sink having a portion thereof exposed to the surroundings of said package;

a thermally conductive element thermally coupled with and interposed between both said semiconductor die and said heat sink, wherein said thermally conductive element does not directly contact said semiconductor die; and

an encapsulant material encapsulating said thermally conductive element and said heat sink such that said portion of said heat sink is exposed to the surroundings of said package, wherein a top portion and a side portion of said heat sink are exposed to the surroundings of said package.

4. (One Time Amended) The integrated circuit package of claim 3 [1], wherein said thermally conductive element is made of a material from the group consisting of alumina, aluminum nitride, beryllium oxide, ceramic material, copper, diamond compound, and metal.

5. (One Time Amended) The integrated circuit package of claim 3 [1], wherein said integrated circuit package is a ball grid array integrated circuit package.

6. (One Time Amended) The integrated circuit package of claim 3 [1], further comprising an interface element interposed between said thermally conductive element and said semiconductor die.

8. (One Time Amended) The integrated circuit package of claim 3 [1], wherein a distance between said semiconductor die and said thermally conductive element is about five (5) mils or less.

9. (One Time Amended) The integrated circuit package of claim 3 [1], wherein said semiconductor die is electrically connected to said substrate by direct chip attachment.

10. (One Time Amended) An integrated circuit package, comprising:
a semiconductor die electrically connected to a substrate;
a heat sink having a top portion and a side portion thereof exposed to the surroundings of said package;

means for thermally coupling said semiconductor die with said heat sink to dissipate heat from said semiconductor die to the surroundings of said package, wherein said means for thermally coupling is interposed between said semiconductor die and said heat sink but does not directly contact said semiconductor die; and

means for encapsulating said thermally conductive element and said heat sink such that said top portion and said side portion of said heat sink are [is] exposed to the surroundings of said package.

13. (One Time Amended) The integrated circuit package of claim 12, wherein said interface element is in direct contact with said semiconductor die [heat sink].

20. (One Time Amended) The integrated circuit package of claim 11 [1], wherein said integrated circuit package is a ball grid integrated circuit package.

21. (One Time Amended) An integrated circuit package, comprising:
a substrate comprising:

means for electrically interconnecting a semiconductor die; and

means for exchanging electrical signals with an outside device;

a semiconductor die attached and electrically connected to said substrate by

attachment means;

a heat sink having means for dissipating thermal energy to the surroundings of
said package, said means comprising a top portion and a side portion;

means for thermally coupling said semiconductor die to said heat sink to dissipate
heat from said semiconductor die to the surroundings of said package, wherein said means for
thermally coupling is interposed between said semiconductor die and said heat sink but does not
directly contact said semiconductor die; and

means for encapsulating said semiconductor die, said thermally conductive
element and said heat sink such that said top portion and said side [a] portion of said heat sink
are [is] exposed to the surroundings of said package [but is substantially encapsulated].